Cryogenic Stepping Piezomotor for Large Torque, Precise Rotary and Linear Motion Control in Passive Optics, Phase II

Completed Technology Project (2007 - 2009)

Project Introduction

TRS Technologies, Virginia Tech., and MTech, Inc. propose to develop high torque (>1.5 kg-cm), lightweight (< 250 g), low power (< 2 watts), high precision (<0.2

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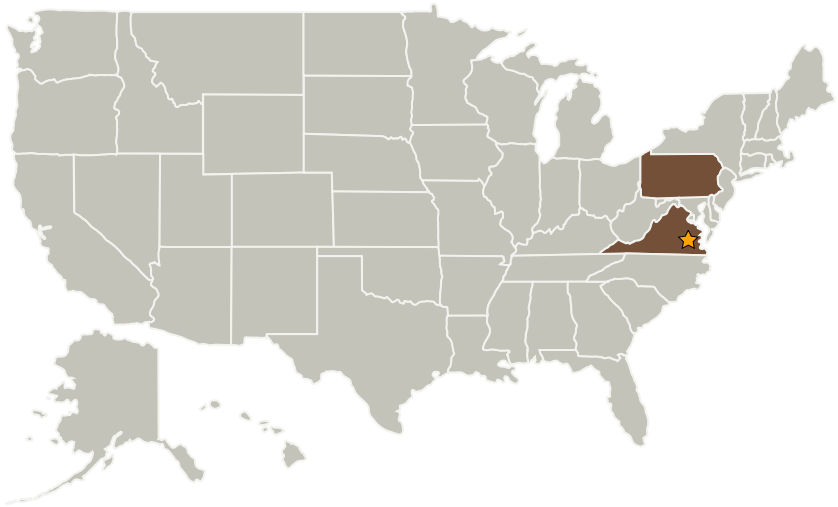
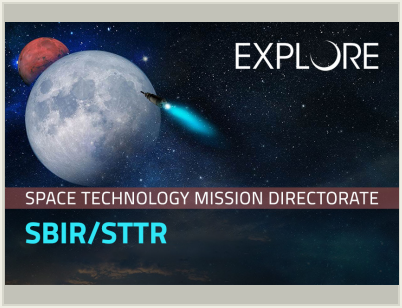
), cryogenic stepping motors using single crystal piezoelectric technology. The ultrasonic motors developed on this program will be targeted for use in passive optics positioning systems and interferometers in IR remote sensing and space telescope applications. The above metrics were achieved during the Phase I program using a traveling wave ultrasonic motor with single crystal drive elements. Motor operation was also demonstrated at 77K. In Phase II, motor torque and speed will be increased and size, weight, and power will be further decreased by optimizing the motor design and crystal element configuration. Drive electronics optimized for operation from 300 to 77K will also be developed. Finally, the motor and electronics will be extensively tested at cryogenic conditions and under thermal cycling for reliability and repeatability. At the conclusion of the Phase II program TRS and our partners will have optimized and characterized piezoelectric ultrasonic motors capable of operating over a very broad temperature range (400 to < 77K) with significant performance improvements (torque, speed, precision, and power) over competing technologies with narrower temperature ranges.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
TRS Ceramics, Inc.	Supporting Organization	Industry	State College, Pennsylvania

Primary U.S. Work Locations	
Pennsylvania	Virginia

Project Transitions

November 2007: Project Start

November 2009: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors